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BULLETIN

OF THE

TORREY BOTANICAL CLUB.

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New or Little Known Grasses—II.*

By F. Lamson-Scribner.

(Plates CV-CVIII).

Some months ago I received from the Botanist of the United States Department of Agriculture specimens of a diœcious grass—both the male and female plants—collected on the sandy coasts of Lower California, by Dr. E. Palmer. The characters presented by these specimens were in some respects remarkable and wholly unlike any species known to me. The characters of the female plants at once suggested those of *Jouvea straminea,* Fourn. (Bull. Soc. Roy. Bot. de Belgique, xv. p. 475) and a very careful further study of the material in hand has led me to the conclusion that this grass is none other than that rare species, which was unknown to Bentham and has never been seen by Prof. Hackel. While differing in some apparently essential points from the published descriptions of *Jouvea straminea,* there is such an agreement in the characters, especially in those which are most remarkable, that until we can make a comparison with the type, I must consider our plant certainly *Jouvea,* and in all probability *J. straminea,* which is diagnosed by Fournier (in Pl. Mex. ii. p. 68) as follows:

Jouvea. Gramen littoreum, junciforme. Spica terminalis, cylindrica acuta. Spiculæ unifloræ, dioicæ, in rhachide immerse et illi in parte inferiore adnatæ. Masculæ non notæ. Feminearum glumæ *duæ,* exterior cartilaginea, straminea, *interna hyalina,* apice tantum a rhachide distincta. *Paleæ duæ, augustæ minores;* stylus longus, stigmatibus 2, flore exeuntibus; *squamulis triangularibus.*

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* For No. 1, see Bulletin, xv. 8-10.

J. straminea. Culmo striato, angusto, pedali, stramineo, glabro, nodis nigrescentibus, merithalliis 1-foliolatis; ligulis laciniatus pilosis, foliis linearibus, acutis, brevibus, pungentibus; spicis femineis 1–2, terminalibus cylindricis acutis; spiculis 1–3, alternis in rhachide immersis; gluma exteriore ab axe fissura tantum in parte superior discreta, *interior hyalina;* caryopsis immatura, in stylum *attenuata,* stigmatibus 2, plumosa, emergentibus.—In arena littoralis meris Pacifici, San Augustin (Lehm.).

Fournier saw only the pistillate plant and the specimens from which his description was drawn were evidently young, for he says: "caryopsis immatura." The specimens collected by Dr. Palmer are all very old and this difference in the state of the plants may account for some of the differences in the characters between our specimens and those described by Fournier. The points of disagreement in the above quoted description are in italics.

In our plants the outer glume in the ♀ spikelet is grown to the rhachis for four-fifths or five-sixths of its length. If it is understood that "in parte inferiore adnatæ," can only mean "adnate for half their length" or "their lower half adnate," we have a character not applicable to our plant; but does the expression demand a rendering which limits so definitely the extent of adnation? It is possible that in young plants the glumes are not so completely grown to the rhachis as in those which are mature.

In Palmer's specimens the limits of the adnate, cartilaginous outer glume are clearly visible in a transverse section of the spike made near the base of the spikelet and the cellular structure seems to indicate that it is seven-nerved. On the inner face and continuing entirely around the grain-cavity are several layers of dense sclerenchyma cells. Those cells which line the back of the cavity may belong to the "hyaline inner glume," but this glume cannot be distinguished excepting at the free apex, where it is grown by its edges to the outer glume, thus forming a short tube through which the rather stout style projects (fig. n, pl. CVI.)

I have been unable to find any traces of a flowering glume or palea. Fournier found both these organs, and although he mentions their shape and size, he says nothing of their texture. If they were very thin and hyaline, it is possible that they may have become adnate to the mature grain and wholly undistinguishable. The outer layer of irregular, thin cells covering the grain, seen in transverse sections, may belong to these organs.

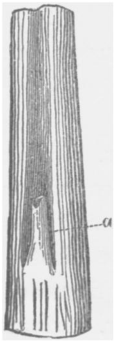
In all the characters excepting those here noted, and which we have tried to account for, our plant accords with *Jouvea straminea*, Fourn. The type specimens were collected on the sandy shores of the Pacific, within the same region as those gathered by Dr. Palmer, and although it is possible that two genera possessing such unusual characters might exist in that region, growing under like conditions, and have escaped the notice of botanists until now, it certainly does not seem probable, and considering that our plant agrees in so many and striking particulars with the published description of *Jouvea*, I think we ought to try to explain or harmonize any apparent differences rather than attempt to establish a new genus. Certainly it would be unwise to do this before we are assured of a valid distinction by a comparison with Fournier's types.

The characters of the genus *Jouvea*, based upon our specimens, are as follows:

JOUVEA, Fourn.

Spikelets unisexual, diœcious, very dissimilar, ♂ much compressed, many-flowered, spicate on slender terminal or lateral peduncles, rhachilla continuous. Empty glumes two, thin, the second one-nerved and larger than the first (in old specimens the empty glumes, particularly the first, are rarely present); flowering glumes longer and broader, carinate, acute herbaceo-chartaceous, three-nerved; palea broad and prominently two-keeled, stamens three. Female spikes one–several in terminal fascicles on the culm or its branches, enclosed below by the leaf-sheaths or broad prophylla terete, acute, articulated at base and falling off entire. Spikelets one-flowered, embedded in the continuous rhachis, adnate below. Outer glume cartilaginous, abruptly narrowed towards the free apex. Style single, long-exserted; stigmas two, plumose. Grain subterete, free.

Jouvea straminea, Fourn.? (*Rachidospermum Mexicanum*, Vasey, Bot. Gaz. xv. 110). Culms erect froma creeping rhizome, about 30 cm. high, striate, smooth, solid, the internodes flattened or sulcate upon alternating sides branched, the branches erect and enveloped at the base by the short and somewhat dilated leaf-sheaths and strong prophylla, the latter being remarkably developed in aborted branches of the ♀ inflorescence. Lower sheaths crowded and over-lapping, those above much shorter than the internodes; ligule a ciliate fringe of short hairs, the hairs at the sides longer; leaves 1-10 cm. long, the uppermost shortest and divergent, all pungent-pointed, conduplicate, scabrous on the prominent striæ of the upper surface and a few scattering hairs near the margins. Staminate spikes 3-6 cm. long; spikelets three to six, sessile on alternate notches of the slender rhachis, 1½-3 cm. long, about 3 mm. wide, much compressed, ten- to eighteen-flowered. Flowering glumes 4-5 mm. long, broadly lanceolate, acute, with a strong keel, which is scabrous above, and a distinct lateral nerve on each side about half as long as the glume. Paleas somewhat shorter than the glumes, finely scabrous on the prominent keels. Female spikes 2-3 cm. long, somewhat concave on one side near the base, otherwise terete and very sharp-pointed, often a little curved and spur-shaped; spikelets one to three, alternate, 6-8 mm. long, deeply embedded in the rhachis to which the glumes are firmly adnate for four-fifths or five-sixths of their length. Style springing from one side of the top of the ovary, often bent back near the base and projecting through the conical-tubular apex of the glumes. Grain about 6 mm. long.



A portion of a ♀ spike of *Jouvea straminea*, Fourn.? showing the tubular free apex of the glumes, *a*.

I have referred this grass to *Jouvea straminea* with a query because Fournier's description, drawn as it was from an immature female plant, renders a positive identification from this alone, nearly impossible.

It appears* that the male and probably also female plants of this grass were collected at Cape St. Lucas, Lower California, by Xantus in 1859-'60. The first (No. 121 of the collection) was referred by Dr. Gray, in his account of Xantus' plants, to the present genus *Distichlis*. Of the probable female plant (No. 119) it is said "a new grass of uncertain genus, the single specimen mislaid." Very likely the male plant has been already published under *Brizopyrum* or *Distichlis*, to which genus it bears a general resemblance, but from which it differs markedly in its solid culms, its manner of branching, sessile spikelets and three-nerved flowering glumes. Fournier, who knew only the female plant, allied *Jouvea* with *Buchloë*, and Bentham followed him in Genera Plantarum (vol. iii. p. 1173). The genus has, however, no affinities with the Chlorideæ. Judging from the characters of the female spikes, as given by Fournier, Prof. Hackel (in Engl. und Prantl, Nat. Pflanzenfam. 2, vol. ii. pp. 76, 78; the "True Grasses," pp. 170-174) placed *Jouvea* near *Monerma* and *Ischnurus* in Hordeæ. Although the position here assigned is, to me, unsatisfactory, I am unable to find another where the peculiar characters of the grass will render the relationship less questionable. As the tribes of the family are defined by Bentham and by Hackel our grass would certainly fall under Hordeæ, and would not fall under any of the others excepting the characters of these be modified. If properly referred, it is remarkable as being the only diœcious grass among the Hordeæ.

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*Botanical Gazette, xv. p. 109.

PENTARRHAPHIS FOURNIERANA, Hack. & Scribn.

Among the plants collected by Mr. C. G. Pringle in Guadalajara, Mexico, in 1889, there is a grass which in a recent collection from the same region (Palmer No. 200, 1886) was referred to *Bouteloua*, (*B. Fourierana*, Vasey, Proc. Amer. Acad xxii. 461, without description) but from which genus it differs in several essential characters. I sent samples of this grass, along with some others of Pringle's collection, to Prof. Hackel, and in referring to the lot Hackel says: "There are several very interesting species in it, and above all there is what I believe to be the long-forgotten and doubtful genus *Pentarrhaphis* of Kunth, represented by Pringle's No. 2559. It does not match fully the species described by Kunth in Humb. Bonpl. Nov. Gen. et. Spec. i. p. 178, t. 60, viz. *P. scabra*, but differs in several points, chiefly in having *two* spikelets on each node of the rhachis instead of one, and in the smaller number of setæ at the base of the twin spikelets. These setæ, which Kunth believed to be the teeth of a supposed "gluma sterilis inferior," are in my view, the relics of a whole rudimentary spikelet. You will often have observed in several Boutelouæ (the genus to which *Pentarrhaphis* is very nearly allied) that the rhachilla of the spikelet is headed by a group of bristles (in *B. multiseta*, for example, by many) which are reduced glumes. Now in *Pentarrhaphis* I believe the group of bristles at the base represents a whole rudimentary spikelet. The number of these setæ seems to be somewhat variable, as is often the case with rudimentary organs. As you have fuller materials for investigation I invite you to make a closer study of it, and should you gain the same opinion as myself regarding it, I propose for the species the name *Pentarrhaphis geminata*, Hack. & Scribn.

"I believe that *Polyschistis*, Presl. (in Rel. Hænk. i. p. 294) is quite the same genus, and his *P. paupercula* seems even to be very nearly allied to *Pentarrhaphis geminata*. But I can only judge of this from Presl's figure, not from authentic specimens, which I sought for in vain in the Vienna Herbarium. Presl says that Hænke collected it in Luzone, but he very often confounded plants from Mexico with those from the Philippines, and *vice versa*."

After making a careful investigation of the spikelets and the bristles or setæ accompanying them, I communicated my conclusions, detailed below, to Prof. Hackel, and in reply he says: "I fully agree with you in the signification that you give to the various bristles that accompany the base of the twin spikelets. As to the number of five bristles, described by Kunth, I venture the view that one of them was the outer glume, the rest forming two pairs, each representing a sterile spikelet. I found also in your specimen one example of a single spikelet [in the cluster] and I think it was accompanied by five or six bristles."

I found several such examples as here referred to, in my specimens, always the lowermost clusters in the racemes. Fig. B, Plate CVIII illustrates one of these. At the base of this spikelet on the upper or outer side, is the second empty glume, *a*, while on the lower or inner side are several strongly pilose setæ (three of which are undistinguishable from one another when dry, the fourth being evidently the second spikelet very imperfectly developed. From the position of these setæ they might easily be mistaken for a quadripartite lower glume, such as Presl describes for *Poly-*

schistis, "gluma inferiora quadripartita, flora brevior, laciniis lineari-subulatis, pilosis." Supposing one of these bristles to have been bifid, as at *c*, plate CVII, only more deeply so, there would then exist a striking resemblance to the lower glume of *Pentarrhaphis,* as described by Kunth: "gluma inferior ex aristis quinque basi subconnatis composita."

In the clusters or fascicles with two well developed spikelets these spring from a very much shortened, hirsute axis so that they appear to stand opposite each other, the backs of their lowest glumes coming together, see figure A, plate CVIII. Between the spikelets are three setæ or awn-like bristles, one of which is often more or less deeply two-parted. These bristles, shown more clearly in figure C, are sub-equal in length, similarly pilose and projecting in the same line of growth with the spikelets, and appear to be, at least when examined dry, all of the same nature. If moistened, however, and then carefully examined under a lense, two of them will be found to have upon each side below a narrow membranous margin (see figs. *b'*, *b'*, plate CVII); this character, together with that of their position, determines them to be the lower empty glumes of the two spikelets. The third seta is either simple or bifid and originates at a point a little to one side or in advance of the lower empty glumes. It may be said to occupy the centre of the fascicle of which it forms a part, representing the rudiment of a third spikelet. That it is not a continuation of the partial rhachis, but really the representative of a third spikelet, is determined, I think, by the following characters: (1) its direction of growth in the same line with the fully developed spikelets; (2) its springing from the same very hirsute and condensed axis of these spikelets, which is (to me an important point in this connection) articulated with the short pedicel from the main rhachis; (3) its being pilose like the empty glumes, the extended midribs or awns of which it most closely resembles. In those Boutelouæ with which I am familiar, wherein the rhachis of the spikes is produced beyond the spikes, the primary direction of this rhachis is continued, and although it may be reduced to a sharp point or even become notched or bifid as in *Bouteloua disticha*, Benth. (*Polyodon distichum*, HBK.) there is no question as to its true character.

Assuming that the foregoing views respecting the nature of the setæ at the base of the single spikelet or pair of spikelets, to be correct, the genus *Pentarrhaphis*, placed among those regarded as doubtful by Bentham (Gen. Pl. iii. p. 1090) and founded upon a single Mexican species which has been completely lost to recent botanists, may be characterized as follows:

PENTARRHAPHIS HBK. Nov. Gen. et Spec. i. p. 177, t. 60. (*Polyschistis* Presl, Rel. Haenk. i. 294, t. 41).

Tribe Chlorideæ.

Spikelets one to two in each fascicle-like spike, accompanied by one to four shorter, awn-like rudiments, two-flowered, the first flower ♀, the second ♀ or ♂; rhachilla produced into a short simple bristle behind the palea of the second floret. Empty glumes two, one-nerved, the first very narrow, awn-like when dry, the second somewhat longer, lanceolate, usually two-toothed, awned between the teeth; flowering glumes five or seven-toothed, the middle and marginal teeth extending into a long, divergent, scabrous awn. Palea strongly two-nerved, two-toothed or sometimes briefly two-awned. Stamens three; styles distinct. Stigmas projecting from the sides of the florets, penicilliform. Lodicules two, dolabriform. Grain oblong, free. Low, slender, tufted grasses with erect, simple or branched flowering culms and narrow flat leaves. Spikes very short, secund and rather remote along the flexuose and sometimes arcuate rhachis, articulated with the very short pedicels and falling off entire.

The disposition and appearance of the clusters of spikelets and also their deciduous character are the same as in *Ægopogon*; their external resemblance to *Melanocenchris*, with which this genus is very closely allied, is even more marked. In the first, however, the separate spikelets are one-flowered and pedicellate in the clusters; in the second, the spikelets are one-flowered, above which the rhachilla bears several empty bracts similar to the flowering glume. From *Bouteloua*, section Triathera, *Pentarrhaphis* may readily be distinguished by its two-flowered spikelets and simple, bristle-like prolongation of the rhachilla.—Species three, two certainly and probably also the third, Mexican.

P. FOURNIERANA, Hack. and Scribn. Culms densely crowded along a creeping rhizome forming a thick, dense turf, erect, 18 to 25 cm. high; nodes silky villous with erect hairs; sheaths very slightly inflated, sparsely pilose and hairy at the throat; ligule a ring of short hairs; leaves about 1 mm. wide, pilose, especially the longer ones from the base, upper leaves 1½ to 3 cm. long, all very acute; spikes three to six, secund-racemose along the somewhat compressed rhachis. Spikelets two in each cluster with a single, simple or bifid, awn-like rudiment of a third, sessile. Empty glumes pilose with rather long, stiff hairs, hirsute at the base, much shorter than the spikelets; flowering glumes densely hairy at the base and more or less pilose along their margins.—Mexico, (Pringle, No. 2,559, 1889; Palmer, 200, 1886).

Pentarrhaphis scabra, HBK., has taller, and branched flowering culms, longer and broader leaves, one spikelet only at each node of the main rhachis, and the lower empty glume and the bristle-like rudiments (according to the illustration in Nov. Gen. et Spec.) are simply scabrous (see fig. *w*, plate CVIII).

In *Pentarrhaphis paupercula*, (*Polyschistis paupercula*, Presl), the lower leaves are short, like the upper ones, spikelets single at the nodes of main rhachis, and short pedicel of the second floret (joint of the rhachilla) pilose. (See figs. x and x′, plate CVIII). According to Presl this species is annual. The descriptions and illustrations of these species given by Kunth and Presl permit of the following brief synopsis of them.

Spikelets two in each cluster, rudiment a single simple or bifid, pilose bristle....................................1. P. FOURNIERANA.
Spikelets one in each cluster, rudimentary bristles three or four.
    Bristles and pedicel of the second floret scabrous...2. P. SCABRA.
    Bristles and pedicel of the second floret pilose.....3. P. PAUPERCULA.

EXPLANATION OF PLATES.

Plate CV.

Male and female plants of *Jouvea straminea*, Fourn.? reduced in size.

Plate CVI.

a.—A portion of the ♀ inflorescence.

b.—A one-flowered ♀ spike, enclosed at the base by a leaf.

c.—A similar spike with the leaf removed, showing prophylla, x.
d.—A two-flowered ♀ spike.
e.—A similar spike, the lower portion in longitudinal section, showing grain cavities.
f.—A section of the lower part of a ♀ spike, made in the same plane as the glume, showing grain, etc.
g.—Grain with a portion of the style.
h, *i*, *k.*—Transverse sections of the spike across a spikelet, showing the grain within.
l, *m.*—Transverse sections of the grain, *l*, includes the embryo.
n.—Free apex of the glumes.
o.—Staminate spikelet.
p.—Floret of same.
r.—Flowering glume of ♂ floret expanded.
s.—A stamen.
t.—A portion of the stem and a branch with a prophyllum, x.
u.—Transverse section of the culm.
v.—Transverse section of a leaf.
w.—Figure showing the ligule.

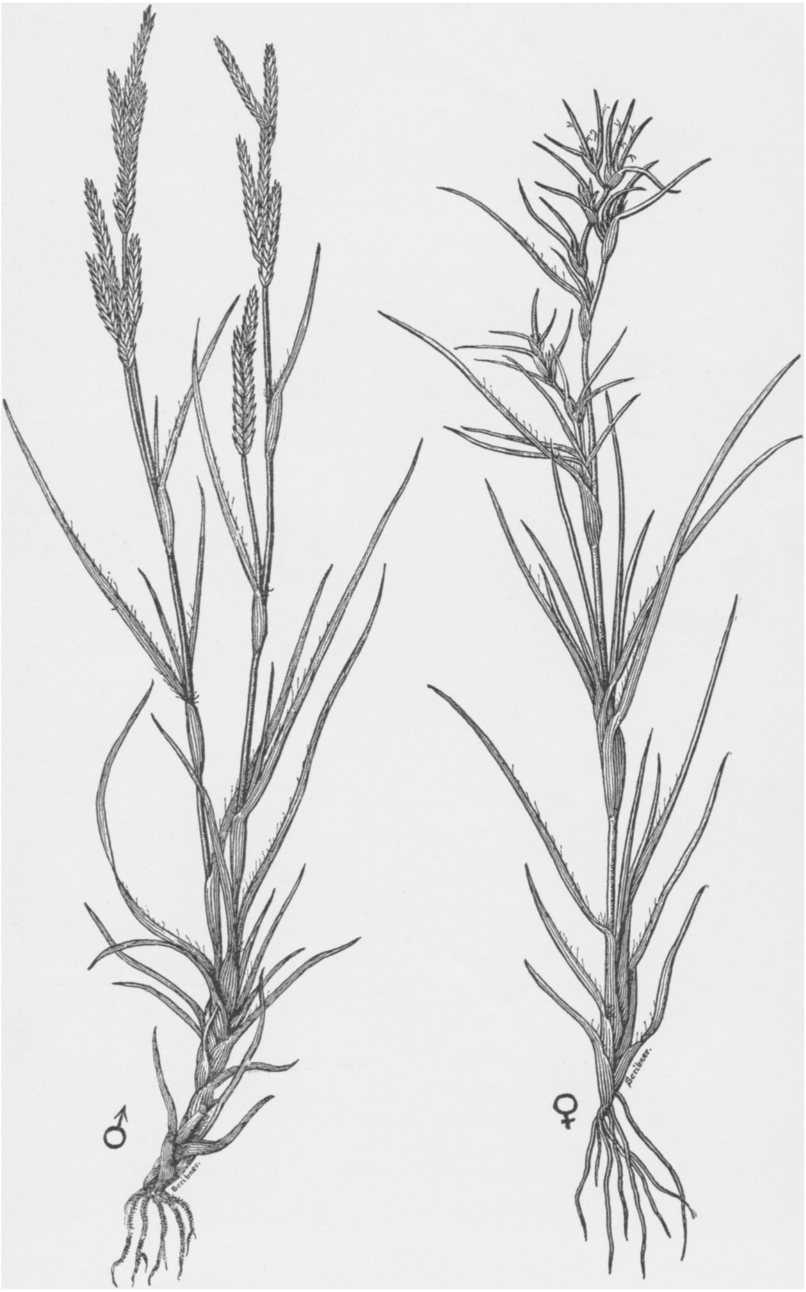
Plate CVII.

H.—A plant of *Pentarrhaphis Fournierana*, somewhat reduced.
b', *b'*.—First empty glumes of the two spikelets, moistened and membranous margins pressed out.
a.—Second empty glume.
f l.—Flowering glume of the first floret.
P.—Palea of same.
c.—Bifid rudiment of the third spikelet.
K.—Pistil with lodicules. with scale of enlargement indicated.
L.—Lodicules spread out.

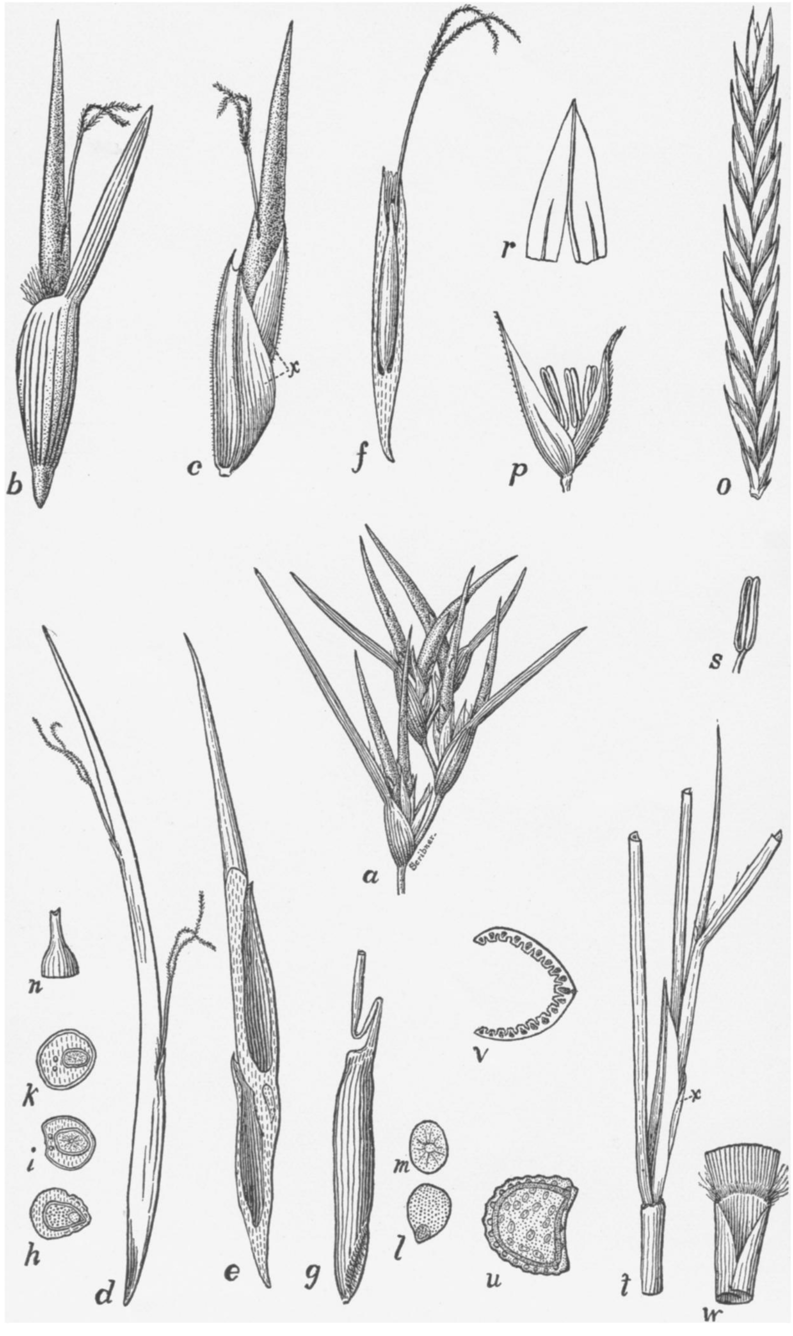
Plate CVIII.

A.—Spike or cluster of spikelets with portion of main rhachis, r.
C.—Cluster of spikelets spread apart to expose the bristle-like lower glumes, *b*, *b*, and bifid rudiment, *c*.
B.—Cluster of spikelets in which the second spikelet is reduced nearly to the form of the bristles.
e.—Anterior view of the pedicellate second floret, showing the prolongation of the rhachilla, f.
w.—Cluster of spikelets of *Pentarrhaphis scabra*, the florets separated from the empty glumes and bristles.
v.—First floret of same.
u.—Second floret of same, showlng prolongation of rhachilla, f'.
X.—Cluster of spikelets of *Pentarrhaphis paupercula* (*Polyschistis paupercula*, Presl).
X'.—Second floret of same, showing the pilose pedicel.

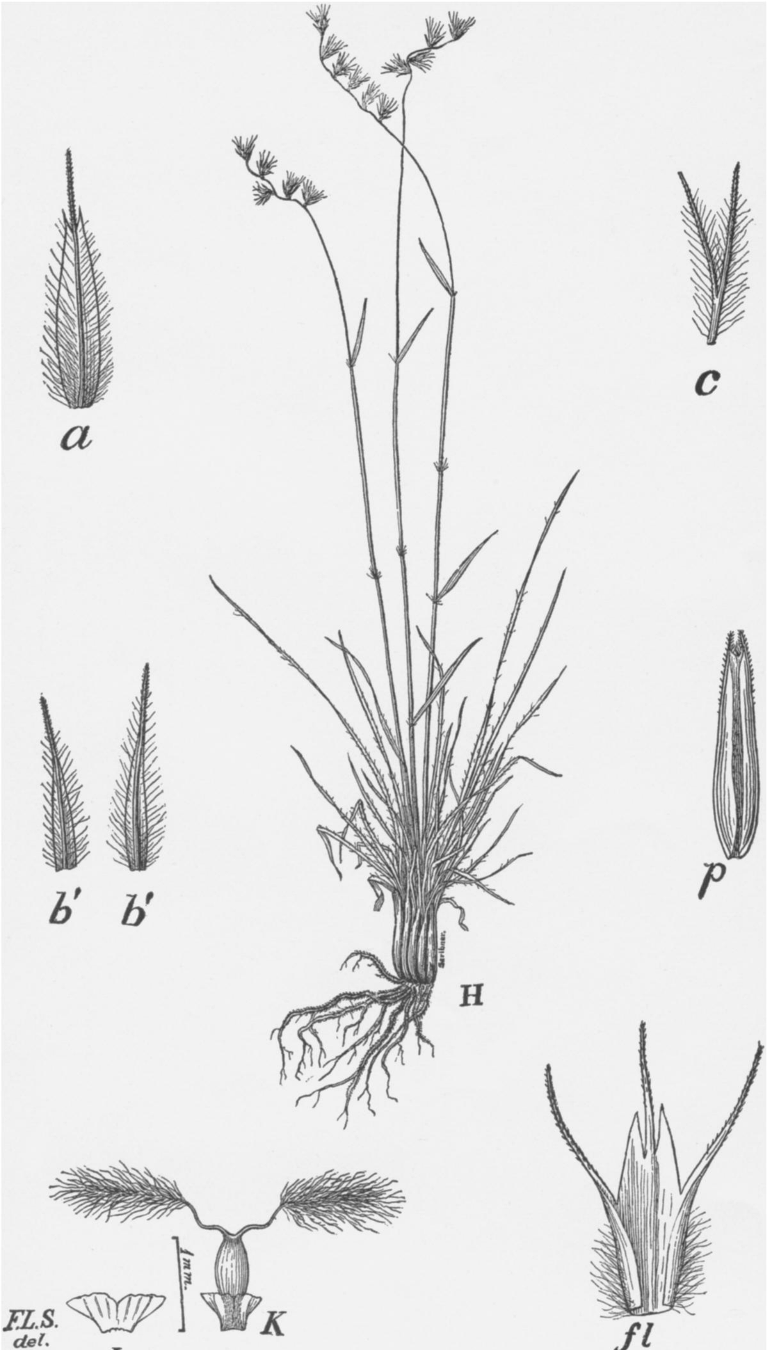
All of plates CV, CVI and CVII, and figures A, B, C and *e* of plate CVIII original. Figures *u*, *v* and *w*, redrawn from Kunth ; figures X and X', redrawn from Presl.



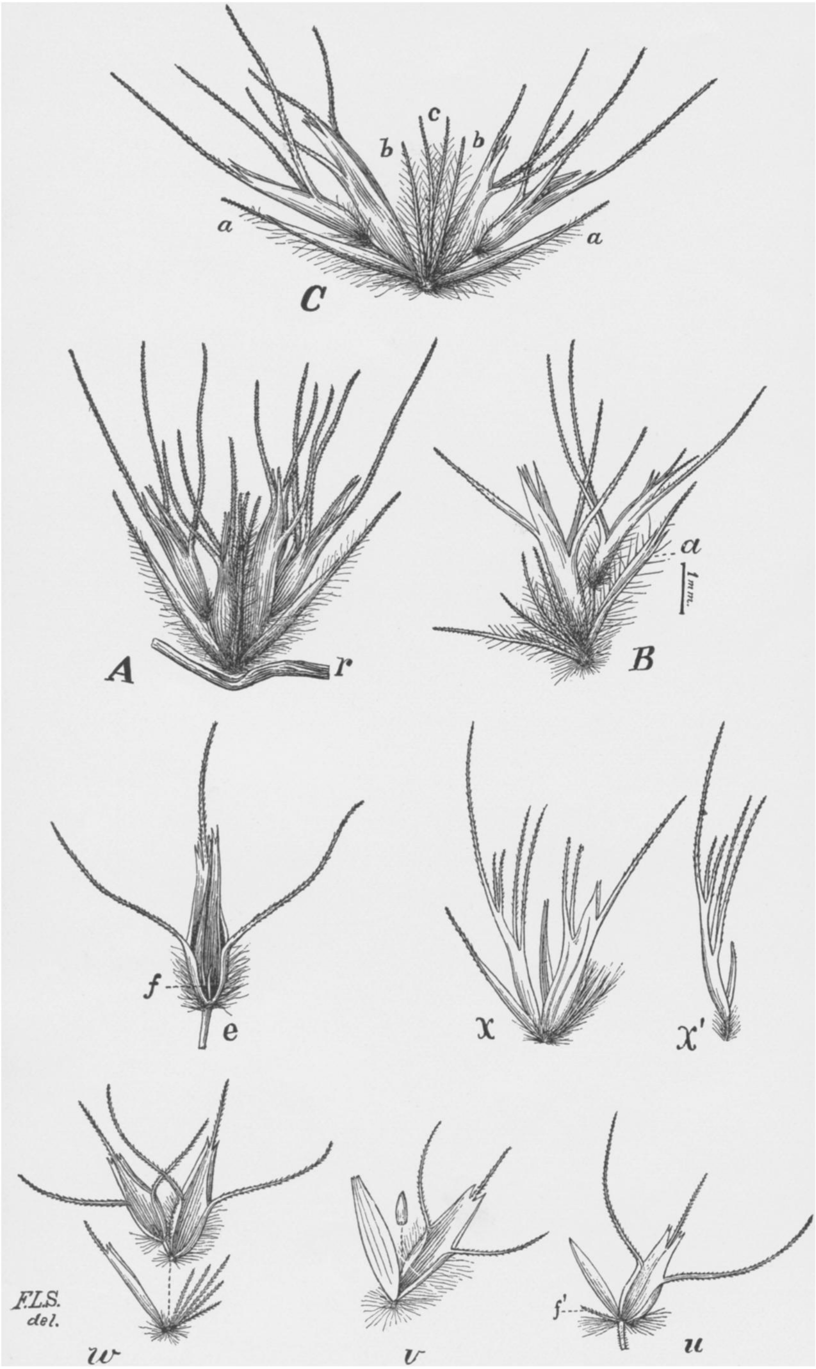
JOUVEA STRAMINEA, Fourn. ?



JOUVEA STRAMINEA, Fourn.?



PENTARRHAPHIS FOURNIERANA, Hack. & Scribn.



PENTARRHAPHIS FOURNIERANA, Hack. & Scribn.